Ontario Geological Survey

Northern Ontario
Engineering Geology Terrain Study 69

AGNES LAKE AREA

(NTS 52B/SW)

District of Rainy River

Compliments of
ONTARIO MINISTRY OF NORTHERN DEVELOPMENT AND MINES
Not for resale

D.G. Mollard and J.D. Mollard

1980

Ontario

Ministry of Natural Resources

Hon. James A.C. Auld
Minister

Dr. J.K. Reynolds
Deputy Minister

Ministry of Northern Affairs

Hon. Leo Bernier
Minister

Art Herridge
Deputy Minister

© OMNR-OGS 1980
Printed in Canada

THIS PROJECT WAS FUNDED BY
THE ONTARIO MINISTRY OF NORTHERN AFFAIRS
AND IS MANAGED BY
THE ONTARIO MINISTRY OF NATURAL RESOURCES

Every possible effort is made to ensure the accuracy of the information contained in this report, but the Ministry of Natural Resources does not assume any liability for errors that may occur. Source references are included in the report and users may wish to verify critical information.

Publications of the Ontario Ministry of Natural Resources and price list are available through the *Map Unit, Public Service Centre, Room 6404, Whitney Block, Queen's Park, Toronto,* and the *Ontario Government Bookstore, 880 Bay Street, Toronto.*

Orders for publications should be accompanied by cheque or money order payable to the *Treasurer of Ontario.*

ISSN 0709-4671
ISBN 0-7743-4345-1

Parts of this publication may be quoted if credit is given. It is recommended that reference to this report be made in the following form:

Mollard, D. G. and Mollard, J. D.
1980: Agnes Lake Area (NTS 52B/SW), District of Rainy River; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study 69, 24p. Accompanied by Map 5075, scale 1:100 000.

1200-80-H of C

CONTENTS

		Page
1.0	Introduction	1
2.0	Physiography and Geological Setting	2
3.0	Engineering Terrain Units	3
	3.1 Bedrock Knob (RN)	4
	3.1.1 Description	4
	3.1.2 Occurrence	4
	3.1.3 Engineering and Planning Significance	4
	3.2 Bedrock Plain (RP)	4
	3.2.1 Description	4
	3.2.2 Occurrence	5
	3.2.3 Engineering and Planning Significance	5
	3.3 Bedrock Ridge (RR)	5
	3.3.1 Description	5
	3.3.2 Occurrence	6
	3.3.3 Engineering and Planning Significance	6
	3.4 End Moraine (ME)	6
	3.4.1 Description	6
	3.4.2 Occurrence	7
	3.4.3 Engineering and Planning Significance	7
	3.5 Ground Moraine (MG)	7
	3.5.1 Description	7
	3.5.2 Occurrence	9
	3.5.3 Engineering and Planning Significance	9
	3.6 Hummocky Moraine (MH)	10
	3.6.1 Description	10
	3.6.2 Occurrence	10
	3.6.3 Engineering and Planning Significance	10
	3.7 Ice-Contact Delta (GD)	11
	3.7.1 Description	11
	3.7.2 Occurrence	11
	3.7.3 Engineering and Planning Significance	11
	3.8 Esker (GE)	12
	3.8.1 Description	12
	3.8.2 Occurrence	12
	3.8.3 Engineering and Planning Significance	12

3.9 Outwash Plain (GO) 13
3.9.1 Description 13
3.9.2 Occurrence 13
3.9.3 Engineering and Planning Significance 13
3.10 Glaciolacustrine Plain (LP) 14
3.10.1 Description 14
3.10.2 Occurrence 14
3.10.3 Engineering and Planning Significance 15
3.11 Alluvial Plain (AP) 16
3.11.1 Description 16
3.11.2 Occurrence 16
3.11.3 Engineering and Planning Significance 16
3.12 Organic Terrain (OT) 17
3.12.1 Description 17
3.12.2 Occurrence 17
3.12.3 Engineering and Planning Significance 17
4.0 Appendix: Examples of Terrain Unit Letter Codes 18
4.1 Simple Terrain Unit 18
4.2 Complex Terrain Unit 19
5.0 References 23

FIGURE

1 – Map of the Quetico-Nipigon area showing moraines and orientation of glacial features 8

MAP
(accompanying report)

Map 5075 (coloured) – Northern Ontario Engineering Geology Terrain Study, Data Base Map, Agnes Lake (NTS 52B/SW). Scale 1:100 000.

Northern Ontario

Engineering Geology Terrain Study 69

AGNES LAKE AREA

(NTS 52B/SW)

District of Rainy River

by

D. G. Mollard[1] and J. D. Mollard[2]

1.0 INTRODUCTION:

This report contains an inventory of regional engineering terrain conditions in the Agnes Lake map-area, District of Rainy River. The area, which covers NTS block 52B/SW, lies between Latitudes 48°00'N and 48°30'N and Longitudes 91°00'W and 92°00'W. The report forms part of a series of publications that provide similar terrain data for some 370 000 km^2 of northern Ontario.

The purpose of the inventory is to assist regional engineering and resource planning studies at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5075, accompanying this report).

---

[1]Consulting Engineering Geologist, J. D. Mollard and Associates Limited, Regina, Saskatchewan.

[2]Senior Consulting Engineer, J. D. Mollard and Associates Limited, Regina, Saskatchewan.

Manuscript approved for publication by the Chief, Engineering and Terrain Geology Section, October 29, 1979. This report is published with the permission of E. G. Pye, Director, Ontario Geological Survey.

Interpretation of black and white aerial photographs, at a scale of approximately 1:50 000, formed the basis of the terrain mapping process. The interpretation was checked against published and unpublished maps and reports which documented previous field visits and observations. During the fall of 1978, roads in the map-area were traversed and observed terrain conditions recorded as further verification of the office studies. Thus, the Data Base Map represents a reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. Further discussion on the mapping techniques, legend format, and possible uses of this engineering geology information is available in the Ontario Engineering Geology Terrain Study Users' Manual (Gartner, Mollard, and Roed 1980), a companion publication to this series of maps and reports.

2.0 PHYSIOGRAPHY AND GEOLOGICAL SETTING:

The topography in the Agnes Lake map-area is characterized by a succession of hills and ridges, and there are numerous lakes. Soil deposits form a thin, discontinuous layer over the bedrock. Elevations vary from 395 to 580 m above sea level. In the southeastern part of the area, the local relief is high and some hills rise as much as 150 m above nearby lakes. A water depth of 85 m has been recorded in Agnes Lake. In the northern part of the area, the local relief is generally less than 60 m. Lakes in high relief bedrock terrain are connected by short rivers with falls and rapids.

A belt of Early Precambrian metavolcanics and metasediments occurs along the international boundary in the southeast corner of the map-area, where the relief is highest. Metasediments are common in the northwestern part of the area. The remainder is underlain mainly by felsic igneous and metamorphic rocks. All of the Agnes Lake map-area lies within Quetico Provincial Park.

3.0 ENGINEERING TERRAIN UNITS:

The engineering terrain units mapped are identified in terms of four components: surface material, landform, topography, and drainage. Format of the legend used in the terrain mapping is described in detail in the Users' Manual (Gartner, Mollard, and Roed 1980). Landform is a very important component because surface and near-surface materials, topographic expression, and the surface and internal drainage conditions are all related to it. Consequently, the engineering terrain units are grouped, for descriptive purposes, according to the dominant landform.

A particular landform can occur as the only component in a simple terrain unit, or as a dominant or subordinate component in a complex terrain unit. The dominant landform usually occupies more than half of a complex terrain unit. Where only one subordinate landform is shown, it usually occupies between 10 and 50 percent of the complex unit. Where two subordinate landforms are shown, the first covers the larger area. Landforms that occupy less than 10 percent of the terrain in a complex unit are rarely indicated in the terrain unit letter code. Where two or three landforms in a complex terrain unit consist of the same material, the landform letter symbols are connected by a dash. Examples of terrain unit letter codes which may occur in this map-area, and an explanation of each, are given in the Appendix.

A large number of complex terrain units has been mapped due to the widespread occurrence of irregular topography. Bedrock, which is situated at or near the ground surface throughout much of the map-area, controls the topography and therefore the surface drainage conditions. Resource development and engineering planning considerations are complicated by these complex conditions.

Noteworthy occurrences of important landforms are described with respect to location, typical materials, topography, and drainage; their significance in geotechnical investigations, regional engineering planning, and resource development is summarized.

3.1 BEDROCK KNOB (RN):

3.1.1 Description:

Bedrock knob landscape (RN) is characterized by an irregular bedrock surface having complex multiple slopes of varying steepness. The cover of glacial deposits overlying the bedrock knobs is generally thin and discontinuous. Much of the glacial overburden consists of bouldery, sand-rich till that was transported only a short distance by the ice.

3.1.2 Occurrence:

Bedrock knobs are the dominant landform in the Agnes Lake map-area. Much of the bedrock knob terrain is underlain by felsic igneous and metamorphic rocks. Several meltwater channels cross this landform east of Agnes Lake.

3.1.3 Engineering and Planning Significance:

Two principal engineering considerations are the large volumes of rock that must be excavated during construction and the generally uniform and solid foundation conditions at shallow depths. However, due to difficult topography and the existence of rock fractures, bedrock knob terrain is considered poor for most types of light construction and for waste disposal. Drilling and blasting are required during the construction of almost all types of engineering works.

3.2 BEDROCK PLAIN (RP):

3.2.1 Description:

The bedrock plain unit (RP) has a low-lying, undulating to rolling surface. The bedrock is generally mantled by a thin and variable cover of glacial material, consisting mainly of boulder-rich, sandy till. The rock plains display considerable local variation. They may consist of bare bedrock or may be covered by till or fine-grained water-laid deposits.

3.2.2 Occurrence:

A large bedrock plain is located west of Poohbah Lake and Sturgeon Lake, in the northwestern part of the map-area. The Maligne River flows through the central part of the unit. A narrow bedrock plain extends south of Poohbah Lake and east to Veron Lake. This entire unit is underlain by Early Precambrian sedimentary and derived metamorphic rocks. The glacial overburden appears to be thin or absent over most rock plain areas. The bedrock surface is cut by many narrow linear depressions.

3.2.3 Engineering and Planning Significance:

Engineering and construction problems relate mainly to the cost of bedrock excavation. Foundation materials are strong, have a low compressibility, and a permeability that is controlled almost entirely by rock fractures. Bedrock plains are poor construction and waste disposal sites, but are still considered better than areas mapped as bedrock plateau (RL), bedrock knob (RN), or bedrock ridge (RR). Drainage courses tend to follow eroded zones of weakness in the underlying bedrock. Many of these depressions occupy preglacial channels that were enlarged by glacial erosion. A large proportion of the ground water in this landform is confined to fractures in the upper 45 to 60 m of bedrock. Permeability varies from impervious to highly pervious, depending on the spacing, depth, and width of fissures in the bedrock. Rock materials have high compressive, shearing, and bearing strengths. Position of the water table varies with topography, being closer to the surface beneath depressions. By careful route selection and proper design of vertical alignment, rock cuts on lower class roads can be avoided or at least the volume of rock to be blasted can be minimized. This is because of the low relief surfaces associated with many of the bedrock plains.

3.3 BEDROCK RIDGE (RR):

3.3.1 Description:

The bedrock ridge unit (RR) consists of long, narrow, subparallel and intersecting bedrock ridges of varying height. Thickness of drift over

the masked bedrock surface varies substantially over short distances. In general, it is relatively thin (1 to 2 m) on ridge tops and thicker on the lower slopes and in the depressions between rock ridges.

3.3.2 Occurrence:

Bedrock ridge terrain (RR) is common in the southeastern part of the map-area, which is underlain mainly by Early Precambrian metavolcanics and metasediments. Many of the ridges are well drained and consist of bare rock. Overburden deposits are thickest in hollows between rock ridges. Meltwater channels are common in this landform and occur mainly in depressions between northeast-trending ridges. A large area of bedrock ridge terrain composed of felsic igneous and metamorphic rocks is located north of Basswood Lake in the central part of the area. Bedrock ridges also dominate the landscape around Kawnipi Lake in the northeastern part of the area. Lineaments associated with major rock structures are common in this landform. Bedrock ridges also occur as a subordinate landform in bedrock knob terrain (RN(RR)).

3.3.3 Engineering and Planning Significance:

The main construction problem is the large quantities of very hard rock that often must be excavated during construction. Drilling and blasting costs can be very high. Bedrock ridge terrain is considered poor for most types of engineering, construction, and resource development. It also has a low rating for waste disposal due to irregular relief, the presence of rock fractures near the ground surface, and the high costs of earthwork construction.

3.4 END MORAINE (ME):

3.4.1 Description:

End moraine (ME), which forms either prominent or inconspicuous till ridges, was deposited along the margin of the glacier. Although the ridges are usually long and narrow, they can be hummocky in places. End moraine consists largely of ice-deposited till and boulders, with minor inclusions of water-laid silt, sand, and gravel. Segments of end

moraine, composed mainly of till, occur with hummocky moraine (MH), kames (GK), and ice-contact deltas (GD) in large moraine complexes that are identified by name in Figure 1. The bedrock surface is nearly always buried in areas of end moraine; however, there are exceptions, and in a few places end moraine ridges have a core of solid rock.

3.4.2 Occurrence:

A low end moraine (ME) follows the southern and eastern shores of Bentpine Lake in the northwest corner of the map-area. Long segments of the morainal ridge are probably bedrock cored. Two other small end moraines are located near McDougall Lake in the northern part of the area.

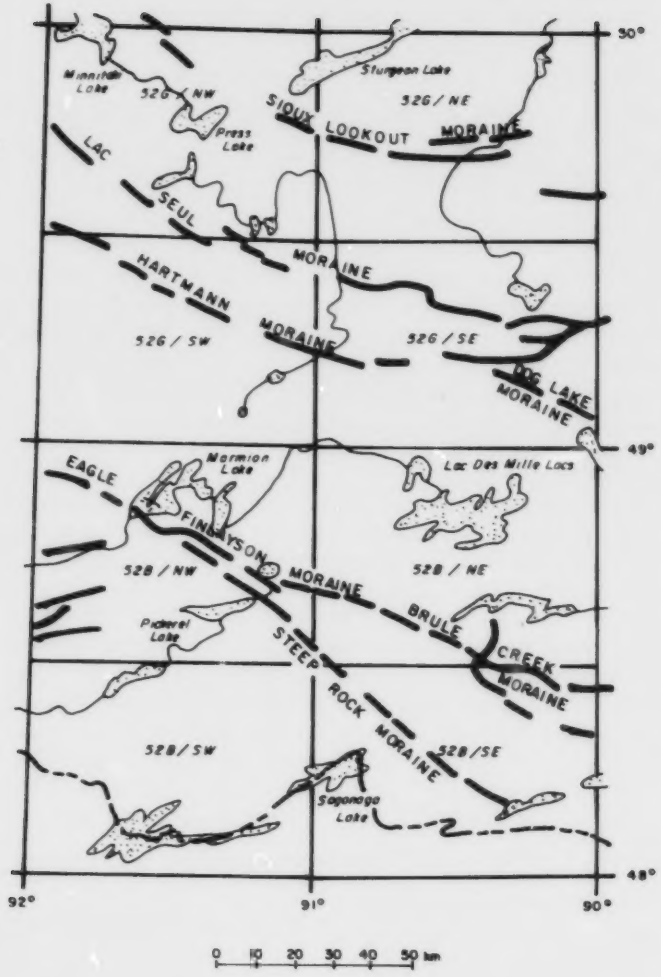
3.4.3 Engineering and Planning Significance:

An important characteristic of end moraines is their variability. Layers of unsorted and unstratified material of varying sizes (i.e. till) can both underlie and overlie sequences of layered silt, sand, and gravel. In general, the boulder content of this landform is high. End moraines in the map-area commonly exhibit variable permeability and internal drainage, low compressibility, and high bearing strength. The water table is low in end moraine ridges. Where the unit consists of till that is high in sand- and gravel-sized material, and where sources of stratified sand and gravel are scarce, the coarse till may sometimes be crushed and used as a source of road-surfacing material. End moraines may present excavation difficulties during the building of roads and structures due to the abundance of small and large boulders.

3.5 GROUND MORAINE (MG):

3.5.1 Description:

The term 'ground moraine' (MG) refers to an extensive deposit of till forming an undulating to rolling plain. Although till is generally composed of an assortment of particle sizes (including clay, silt, sand, gravel,



NOTE: Moraine segments shown in the figure do not necessarily all occur on the Data Base Map accompanying this report.

FIGURE 1 - MAP SHOWING MAJOR MORAINES IN NTS 52B AND 52G (MODIFIED FROM ZOLTAI 1965, FIGURE 3)

cobbles, and boulders), till deposits in this map-area have a high sand and boulder content. The thickness of till in ground moraine varies from less than 1 m to many tens of metres. The landform is mapped as MG where the till is thick enough to mask any topographic effect of underlying bedrock. In general, the till layer forms a mantle less than 3 m thick over the bedrock and is mapped as MG/R. Till in ground moraine tends to be thicker in bedrock depressions and thinner over bedrock ridges and knobs.

3.5.2 Occurrence:

Since bedrock lies at or near the surface in most places, there is very little thick ground moraine till in the Agnes Lake map-area. The only ground moraine unit lies west of Glacier Lake in the east-central part of the area.

3.5.3 Engineering and Planning Significance:

The till in ground moraine is coarse and bouldery, and has moderate permeability and internal drainage, low compressibility, and high bearing strength. Water table position varies with relief, being lower beneath knolls and low ridges and higher beneath depressions. The till in many of the depressions is covered by thin deposits of peat and muck.

The suitability of ground moraine for road and other light foundation construction is fair to good. The fact that the till often forms only a thin mantle over the bedrock (MG/R) has a great deal of significance in road building. Road construction through this type of terrain is difficult due to the bouldery nature of the till and the probability of encountering bedrock in cuts. The suitability of ground moraine for waste disposal varies from poor to fair.

3.6 HUMMOCKY MORAINE (MH):

3.6.1 Description:

Although some hummocky moraine deposits formed along an active ice front, most of the sediments which make up this landform accumulated on the surface of stagnant glacial ice. In time, the buried ice melted and deposited a layer of unsorted till and, in places, washed glacial debris. Most hummocky moraine consists of steep-sided knobs and short ridges separated by undulating to flat plains and swampy kettlehole basins. Soil materials in hummocky moraine include till, usually as the dominant constituent, and subordinate amounts of stratified silt, sand, and gravel in pockets or lenses. Hummocky moraine can be very bouldery. Scattered kames (GK) are a common subordinate landform.

3.6.2 Occurrence:

Hummocky moraine is the dominant landform around Bentpine Lake in the northwest corner of the map-area. It also occurs as a subordinate landform in bedrock knob terrain (RN(MH)) west of Cache Bay (Saganaga Lake) on the eastern margin of the area. Patches of hummocky moraine too small to be mapped are common in bedrock knob terrain.

3.6.3 Engineering and Planning Significance:

Engineering considerations include the large quantities of material that may have to be excavated during construction, a high-content of boulders, and rapid changes in the nature of the materials. Pockets of sand and gravel constitute small sources of construction material of variable quality.

Although variable, most areas of hummocky moraine have moderate permeability and internal drainage, low compressibility, high bearing strength, and low shrink-and-swell potential. In depressions, the till deposits are commonly covered by thin water-laid silt and clay, which in turn are overlain by peat and muck deposits. Hummocky moraine is considered fair to poor for general construction purposes and for waste disposal.

3.7 ICE-CONTACT DELTA (GD):

3.7.1 Description:

Esker deltas, kame deltas, and delta moraines are all varieties of the ice-contact deltas. Some are quite large in area and important in terms of the volume of recoverable sand and gravel they contain. Individual beds, consisting mainly of sand or gravel, are usually better sorted, cleaner, and less variable than stratified deposits in esker and kame landforms. The beds in this unit are also typically less folded and faulted and are more continuous. It is worth noting that materials in many ice-contact deltas are coarse (i.e. gravelly) on the north and northeast sides and finer (i.e. sandy) on the south and southwest sides. These conditions indicate the parts of the delta which were, respectively, closest to and farthest from the glacial front against which the delta was built.

3.7.2 Occurrence:

One small sand and gravel ice-contact delta occurs in the Agnes Lake map-area. It is located immediately south of Poacher Lake, near the international boundary. The elevation of this delta is approximately 425 m above sea level.

3.7.3 Engineering and Planning Significance:

Ice-contact deltas are good potential sources of concrete and blacktop aggregate. They are also favorable sites for the construction of airstrips, roads, and other types of engineering works. Because the subsoils are highly permeable, deltaic (GD) landforms are relatively poor areas for waste disposal. Larger deposits, however, are generally good ground water prospects, especially where sand and gravel horizons are thick and extend below the water table. Ice-contact deltas possess high bearing strength and good workability in wet weather. Slopes are stable and subsoils are well drained. Away from the steeply sloping margins of this landform, earthwork volumes and excavation costs are normally low. Reservoirs and sewage lagoons in ice-contact deltas must be lined to prevent excessive leakage.

3.8 ESKER (GE):

3.8.1 Description:

The ridged landform represented by the esker symbol (GE, >>>) also includes crevasse fillings. Both occur as long, narrow, sand and gravel ridges that can be winding or straight and may widen in places. Some of these elongate ice-contact stratified drift ridges exhibit braided, branching, beaded, and kettled segments. Most of the ridges trend roughly parallel to the last direction of glacial flow. The cores of many eskers and crevasse fillings contain complexly layered units, consisting of sandy gravel and gravelly sand, that exhibit collapse structures (i.e. folds, faults, and pinch-outs of strata). Some silt and fine sand units (waterlaid), boulders, and till pockets may occur within the central parts of eskers and crevasse fillings, as well as along their flanks.

3.8.2 Occurrence:

Eskers are rare in the Agnes Lake map-area. An esker, located immediately east of Eyelet Lake in the northwest corner of the area occurs in association with outwash sand and gravel (GO). Another, located northeast of Poacher Lake in the southern part of the area, occurs in association with a thin mantle of kame material overlying bedrock (GE-GK/R).

3.8.3 Engineering and Planning Significance:

Eskers and crevasse fillings are relatively small and isolated landforms in this map-area, and are generally inferior to ice-contact delta and glacial outwash deposits as sources of good quality granular construction materials. Typically, the unit possesses high permeability and good internal drainage, low compressibility, high bearing strength, low frost susceptibility, and low shrink-and-swell potential. Where esker ridges are steep sided, narrow, and winding, they may be unsuitable for use as transportation routes. They may trend in the wrong direction for route location purposes, but in regions that are dominated by large expanses of swamp and bedrock, eskers are frequently considered as good route location possibilities. Where the sand and gravel in large eskers extends many metres below the water table, the unit represents a potential source of ground water for domestic and, possibly, municipal and industrial use.

3.9 OUTWASH PLAIN (GO):

3.9.1 Description:

Outwash deposits include plains, fans, deltas, and valley trains of varying sizes, all consisting mainly of sand and gravel. Most outwash sediments were drained from the front of a melting glacier and accumulated in flooded lowlands and valley bottoms. Although most outwash deposits formed in proglacial positions, some accumulated over masses of stagnant glacier ice, resulting in pitted or kettled surfaces. Outwash landscapes that show abandoned channel scars, braid bars, or deep kettle holes are commonly coarse in texture (i.e. gravelly and cobbly rather than sandy).

3.9.2 Occurrence:

Areas of sandy outwash (GO) and thin sandy outwash over bedrock (GO/R) are located near Eyelet Lake in the northwest corner of the Agnes Lake map-area. A small esker ridge is associated with these outwash deposits.

3.9.3 Engineering and Planning Significance:

Outwash landforms almost always have high permeability and good internal drainage, low to very low compressibility, low shrink-and-swell tendencies, and high shear strength and bearing capacity, particularly where these granular deposits are confined. Granular materials in outwash landforms form stable slopes and are seldom susceptible to frost heave. Being level and well drained, the sediments in outwash plains are not easily eroded by running water. The boulder content is generally low. A high water table can be expected beneath kettle depressions. Extensive outwash plains provide excellent sites for the construction of roads and airstrips, and are often good sources of concrete and bituminous aggregate. They are good potential sites for ground water development, particularly where the granular deposits are deep and are recharged by water from nearby lakes and rivers.

3.10 GLACIOLACUSTRINE PLAIN (LP):

3.10.1 Description:

Sediments in glaciolacustrine plains consist of varved and massive, fine-grained materials deposited in glacial lake basins of varying size and depth. The proportion of clay, silt, and sand deposited at any particular location in these basins varies with depth of water in the former lake, distance from former shorelines, and the size of particles washed into the lake. Most clay, silt, and sand lacustrine deposits contain minor inclusions of till and scattered dropstones which were rafted into the lake on pieces of ice. In places, wave and current action in former glacial lakes eroded the surface of till deposits, producing thin patches of washed sand, gravel, and boulders that rest on till or bedrock. In other areas, bedrock knobs and ridges are surrounded by pockets of glaciolacustrine sediment. Glacial lake deposits usually consist of clay and silt (cLP, cmLP, mcLP) which accumulated in deep offshore waters at a depth where the bottom was no longer affected by wave action. Closer to shore, and at points where rivers discharged sandy materials into the lake, the deposits usually consist of fine and medium sand with minor silt (sLP, smLP). Most of these sandy lacustrine deposits accumulated in deltaic environments.

3.10.2 Occurrence:

Glacial Lake Agassiz covered the western part of the Agnes Lake map-area. Lacustrine clay and silt underlie organic deposits in most low-lying areas. Lacustrine deposits in poorly drained depressions are small and scattered, and are separated by irregular bedrock exposures. Lacustrine silt and clay occur beneath a veneer of peat (OT/LP) in large hollows in the northwestern part of the area, at an elevation of approximately 380 m above sea level. In the north-central part of the area, lacustrine deposits are found at an elevation of approximately 395 m.

A larger area of lacustrine clay and silt, with patches of organic cover, occurs near the Cache River in the northeastern part of the map-area and is mapped as LP and OT/LP. Lacustrine deposits also form complex terrain units in association with silty alluvial plains. A sandy lacustrine deposit occurs near the Wawiag River in the northeast corner of the area.

3.10.3 Engineering and Planning Significance:

Glaciolacustrine clay deposits (cLP) have high water retention capacity, low permeability, and poor internal drainage, most of which is controlled by a network of closely spaced joints. Characteristically, these landforms possess low density, low bearing strength, and moderate to high compressibility, unless the fine-grained sediments have been consolidated by the weight of overriding glacier ice or by desiccation. The clay sediments usually provide poor foundation conditions and can be difficult to work with heavy construction equipment during wet weather. Most clay plains in the map-area are level to gently sloping. The sides of river valleys which have been deeply incised into these fine deposits are usually highly dissected and are susceptible to rill-and-gully erosion on freshly cut ditch and highway back slopes. Higher and steeper natural and man-made slopes are subject to small failures. Where these lacustrine materials carry a high proportion of silt or very fine sand, they are susceptible to frost heave and the formation of frost boils. Subsoil permeability ranges from low to nearly impervious; as noted above, this is largely dependent on the presence of a system of closely spaced joints. In locations where glaciolacustrine clay sediments are highly plastic, they have a tendency to shrink or swell with changes in moisture content. Bearing capacity, shear strength, and compressibility vary greatly with differences in previous loading history and, therefore, the natural moisture content. Bearing capacities can be low in wet areas, particularly where plastic clay soils are normally consolidated or only slightly consolidated.

Low-lying clay plains have a high water table and are subject to local flooding during spring runoff and heavy cloudbursts. During wet weather, the glaciolacustrine clay sediments have poor workability characteristics for building roads and structures. This landform usually provides good sites for waste disposal because of its low permeability.

Lacustrine sand plains (sLP) contain mostly fine and medium sand with minor silt. Coarse sand, gravel, cobbles, boulders, and till are rare in these deposits. Sand plains are gently sloping to undulating and are well drained. A high water table may occur at sites located some distance from the ground water lowering effects of deep valleys and ravines. Sandy lacustrine materials are typically nonplastic and have high permeability, low compressibility, moderate to high bearing capacity, and high shear

strength. They are generally not frost susceptible unless they contain a significant amount of silt and very fine sand. They represent fair to good terrain for most construction, especially that of roads and airstrips. They are poor for waste disposal due to the possibility of effluent seepage and ground water contamination.

3.11 ALLUVIAL PLAIN (AP):

3.11.1 Description:

Many alluvial deposits (AP) in this map-area consist of fine and medium sand at depth; these materials are commonly overlain by a silty upper stratum of variable thickness. Oxbows and abandoned channel segments occur where meandering streams cross landforms composed largely of loose silt and fine sand. Sediments beneath alluvial plains are finer textured where the material being carried by the stream was eroded from clay and silty clay glaciolacustrine deposits. The landform includes flood plains that have been eroded in till and are strewn with boulders, as well as segments of stream valleys where alluvial sediments range in texture from coarse sand to coarse gravel and cobbles. Long and complex alluvial plain systems sometimes include three constituent landforms: low alluvial terraces, alluvial flood plains, and stream channels.

3.11.2 Occurrence:

Alluvial sediments occur extensively in the northeastern part of the map-area, generally beneath a thin veneer of peat and muck (OT/AP). The deposits occupy former glacial meltwater channels.

3.11.3 Engineering and Planning Significance:

Alluvial plains are subject to flooding. The water table is usually situated at or near the surface for much of the year; organic-filled depressions are common. Although some alluvial terraces, flood plains, and channel bottoms represent potential sources of sand and gravel for construction purposes, the high water table may cause problems during excavation of such materials. This landform is generally unsuitable for

transportation routes, general construction, or waste disposal sites because of the high water table and risk of flooding.

3.12 ORGANIC TERRAIN (OT):

3.12.1 Description:

Organic terrain includes varying depths of peat and muck in marshes, swamps, fens, and bogs. No attempt was made to separate these organic landscape types during the mapping. Although peat and muck deposits usually occur as relatively thin surficial layers, in places these organic materials can be several metres thick. Moreover, the thickness of the deposits can change drastically over very short distances.

3.12.2 Occurrence:

Organic terrain is widespread throughout the northeastern part of the Agnes Lake map-area, either by itself (OT) or as a thin veneer over alluvial deposits (OT/AP). In the northwestern part of the area, organic terrain occurs either as a thin veneer over alluvial or glaciolacustrine deposits, or as a subordinate landform in bedrock knob terrain (RN(OT)).

3.12.3 Engineering and Planning Significance:

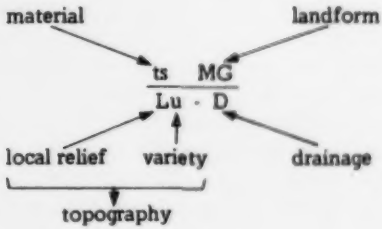
Although organic deposits are commonly thin, they are nonetheless very poor foundation and construction materials. The water table is at or near ground surface for most of the year. The locations of deeper pockets of organic material are difficult to predict reliably without extensive test-drilling. The topography of organic terrain is level or slightly depressional. Peat and muck deposits have low shear and bearing strengths and generally low permeability. They are nearly always poorly drained, highly compressible, and are subject to seasonal flooding. Consequently, they are unsuitable for nearly all types of engineering works and for waste disposal.

4.0 APPENDIX: EXAMPLES OF TERRAIN UNIT LETTER CODES:

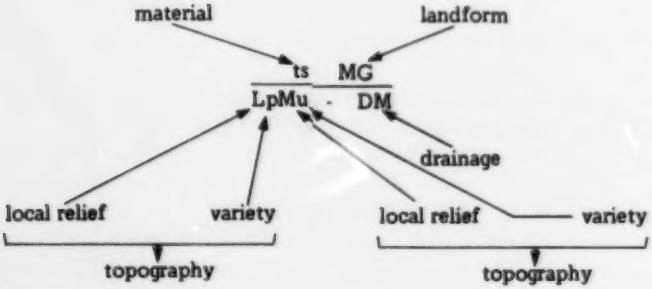
The engineering terrain unit letter codes consist of four components: surface materials, landform, topography, and drainage. The format of the letter codes used in describing the terrain units is discussed in detail in the Users' Manual (Gartner, Mollard, and Roed 1980). Some additional examples of the letter codes are as follows:

4.1 SIMPLE TERRAIN UNIT:

Example 1:



Example 2:

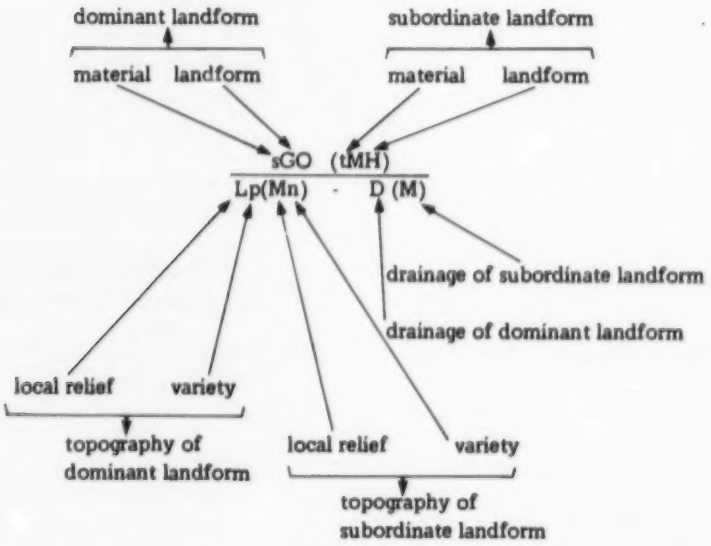


Note: The above type of letter code is used where there are two distinctly different types of topography and/or drainage in a simple terrain unit.

4.2 COMPLEX TERRAIN UNIT:

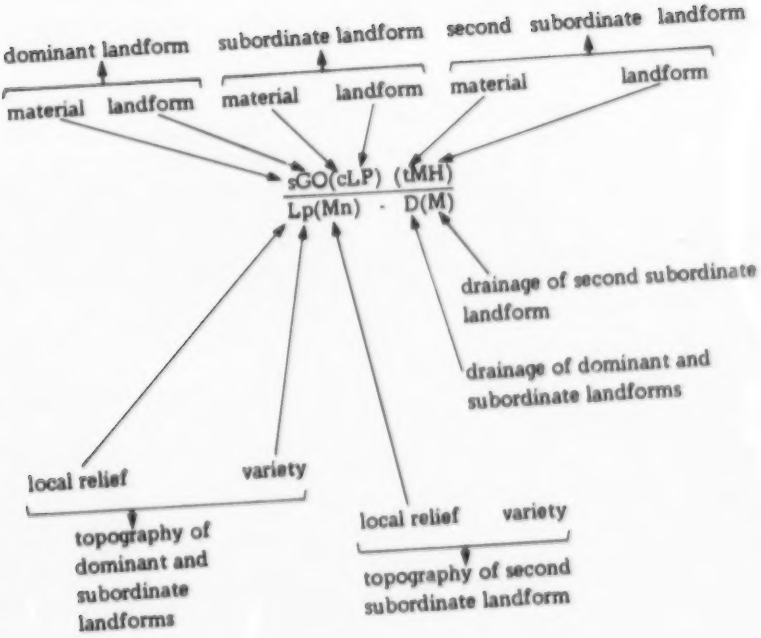
In complex areas, the dominant landform is shown first and the subordinate landform(s) appear in parentheses.

Example 1:



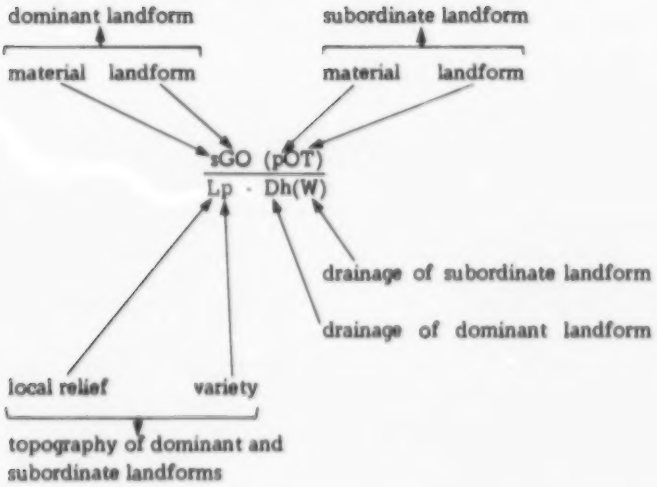
Note: The topography and drainage in parentheses refer to the landform shown in parentheses.

Example 2:



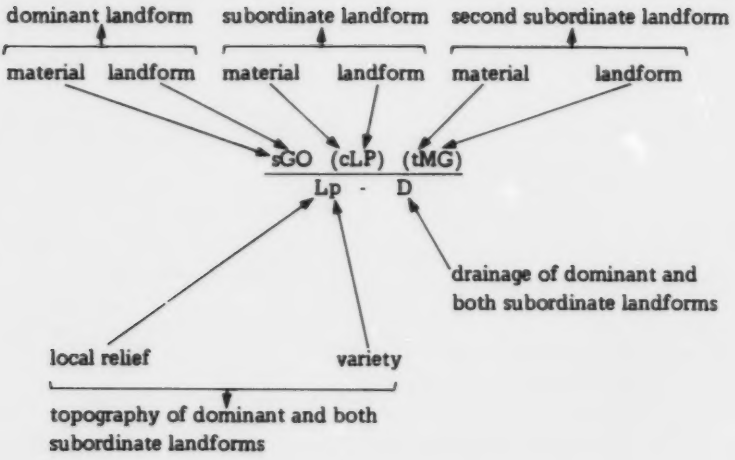
Note: The topography and/or drainage in parentheses refer to the second subordinate landform (in parentheses).

Example 3:



Note: If topography or drainage is similar in the dominant and subordinate landforms, then no topography or drainage symbol is shown in parentheses and the symbol shown applies to both landforms. If topography or drainage conditions are different in one of the landforms, a topography or drainage symbol is shown in parentheses to indicate this difference.

Example 4:



Note: Where topography and drainage conditions are similar in all of the landforms shown, no topography or drainage symbols are placed in parentheses.

5.0 REFERENCES:

Douglas, R. J. W.
1969: Geological Map of Canada; Geological Survey of Canada, Map 1250A, scale 1:5 000 000. Compiled 1966, 1967.

Farrand, W. R.
1960: Former Shorelines in Western and Northern Lake Superior Basin; Unpublished Ph. D. Thesis, University of Michigan, Ann Arbor, 226 p.

Fremlin, G. (Editor)
1974: The National Atlas of Canada, Fourth Edition (Revised); McMillan Company of Canada Limited in association with the Canada Department of Energy, Mines and Resources and Information Canada, 254 p.

Gartner, John F., Mollard, J. D. and Roed, M. A.
1980: Ontario Engineering Geology Terrain Study Users' Manual; Ontario Geological Survey, Open File Report 5288, 99 p.

Ontario Land Inventory
1976: Land Classification, Quetico, 52B, Edition 2 MCE, Series A501; Ontario Centre for Remote Sensing, Ministry of Natural Resources.

Prest, V. K.
1969: Retreat of Wisconsin and Recent Ice in North America; Geological Survey of Canada, Map 1257A, scale 1:5 000 000. Compiled 1969.

Prest, V. K., Grant, D. R., and Rampton, V. N.
1968: Glacial Map of Canada; Geological Survey of Canada, Map 1253A, scale 1:5 000 000. Compiled 1964-1966.

Pye, E. G.
1968: Geology and Scenery, Rainy Lake and East to Lake Superior; Ontario Department of Mines, Geological Guidebook No. 1, 118 p.

1969: Geology and Scenery, North Shore of Lake Superior; Ontario Department of Mines, Geological Guidebook No. 2, 144 p. (Reprinted 1975).

Pye, E. G. and Fenwick, K. G.

1965: Atikokan-Lakehead Sheet, Kenora, Rainy River, and Thunder Bay Districts; Ontario Department of Mines, Map 2065, Geological Compilation Series, scale 1:253 440 or 1 inch to 4 miles. Geological compilation 1962, 1963.

Tanton, T. L.

1938: Quetico Sheet (East Half), Thunder Bay and Rainy River Districts, Ontario; Geological Survey of Canada, Map 432A, scale 1:253 440 or 1 inch to 4 miles. Geology 1928, 1929, 1931, 1936.

Zoltai, S. C.

1962: Glacial History of Part of Northwestern Ontario; Proceedings of the Geological Association of Canada, Vol. 13, p. 61-83.

1965a: Glacial Features of the Quetico-Nipigon Area, Ontario; Canadian Journal of Earth Sciences, Vol. 2, No. 4, p. 247-269.

1965b: Surficial Geology, Thunder Bay; Ontario Department of Lands and Forests, Map S265, scale 1:506 880 or 1 inch to 8 miles. Surficial geology 1958-1960.

MAPS
NOT
FILMED

CARTES
OMISES